SUMMARY PROBLEM

(a) yes; $\Delta H = \dfrac{-9.310 \text{ kJ}}{2.500 \text{ g } CS_2} \times \dfrac{76.13 \text{ g } CS_2}{1 \text{ mol}} = -283.5 \text{ kJ}$

(b) $CS_2(l) + 3Cl_2(g) \rightarrow CCl_4(l) + S_2Cl_2(l) \qquad \Delta H = -283.5 \text{ kJ}$

(c) $-(-283.5 \text{ kJ})(\frac{1}{3}) = 94.50 \text{ kJ}$

(d) mol $Cl_2 = \dfrac{-5.00 \text{ kJ} \times 3 \text{ mol } Cl_2}{-283.5 \text{ kJ}} = 0.0529$; $V = \dfrac{0.0529 \text{ mol} \times 0.0821 \text{ L} \cdot \text{atm/mol} \cdot \text{K} \times 300 \text{ K}}{(812/760) \text{ atm}} = 1.22 \text{ L}$

(e) $-283.5 = -135.4 + \Delta H_f^\circ \ S_2Cl_2 - 89.9; \quad \Delta H_f^\circ \ S_2Cl_2 = -58.2 \text{ kJ/mol}$

(f) $q_{\text{reaction}} = 0.01000 \text{ g } CS_2 \times \dfrac{-9.310 \text{ kJ}}{2.5000 \text{ g}} = -0.03724 \text{ kJ} = -37.24 \text{ J}$

$q_{H_2O} = -q_{\text{reaction}} = -(-37.24 \text{ J}) = 37.24 \text{ J}$

$37.24 \text{ J} = 6.450 \text{ g} \times 4.18 \dfrac{\text{J}}{\text{g} \cdot {}^\circ\text{C}} \times (t_f - 22.0)^\circ\text{C} \qquad t_f = 23.4^\circ\text{C}$

(g) mol $Cl_2 = \dfrac{5.00 \text{ L} \times 2.78 \text{ atm}}{0.0821 \text{ L} \cdot \text{atm/mol} \cdot \text{K} \times 300 \text{ K}} = 0.564; \qquad 0.564 \text{ mol } Cl_2 \times \dfrac{(-283.5 \text{ kJ})}{3 \text{ mol } Cl_2} = -53.3 \text{ kJ}$

mol $CS_2 = 50.0 \text{ mL} \times (1.263 \text{ g/mL}) \times (1 \text{ mol}/76.13 \text{ g}) = 0.0830$

$0.830 \text{ mol } CS_2 \times (-283.5 \text{ kJ/mol}) = -235.3 \text{ kJ}$

Cl_2 is limiting; 53.3 kJ evolved

PROBLEMS

1. $\Delta t = \dfrac{4.78 \text{ J}}{(5.88 \text{ g})(0.523 \text{ J/g} \cdot {}^\circ \text{C})} = 1.55^\circ\text{C}$

3. specific heat $= \dfrac{62.5 \text{ J}}{(5.00 \text{ g})(50.8 - 23.00)^\circ\text{C}} = 0.450 \text{ J/g} \cdot {}^\circ \text{C}$

5. $375^\circ\text{F} = 191^\circ\text{C}$

$q = 0.902 \text{ J/g} \cdot {}^\circ \text{C} \times 473 \text{ g} \times (191 - 23)^\circ\text{C} = 7.16 \times 10^4 \text{ J}$

7. (a) $MgSO_4(s) \rightarrow Mg^{2+}(aq) + SO_4^{2-}(aq)$

(b) yes

(c) q_{H_2O} = 1/51 kJ

(d) $\Delta t = \dfrac{1.51 \times 10^3\ \text{J}}{(4.18\ \text{J/g} \cdot {}^\circ\text{C})(15.0\ \text{g})} = 24.1^\circ\text{C}; \quad t_f = 49^\circ\text{C}$

(e) 77°F; 120°F

9. $225 \times 4.18 \times (t_f - 25) = -[85 \times 4.18 \times (t_f - 25)]; \quad t_f = 42.5^\circ\text{C}$

11. (a) $q_{H_2O} = (35.0\ \text{g} + 35.0\ \text{g}) \times 4.18\ \text{J/g} \cdot {}^\circ\text{C} \times (31.29^\circ\text{C} - 22.0^\circ\text{C}) = 2.72 \times 10^3\ \text{J}$

$q_{rxn} = -q_{H_2O} = -2.72 \times 10^3\ \text{J}$

(b) $n_{NaOH} = 0.0350\ \text{L} \times 1.43\ \text{mol/L} = 0.0501; \quad q_{neut} = 1\ \text{mol NaOH} \times \dfrac{(-2.72 \times 10^3\ \text{J})}{0.0501\ \text{mol}} = -5.43 \times 10^4\ \text{J}$

13. (a) $q_{cal} = (2.115 \times 10^4\ \text{J/}^\circ\text{C})(27.71^\circ\text{C} - 23.49^\circ\text{C}) = 8.93 \times 10^4\ \text{J} = 89.3\ \text{kJ}$

(b) $q_{rxn} = -89.3\ \text{kJ}$

(c) $q = \dfrac{-89.3\ \text{kJ}}{4.50\ \text{g fructose}} \times \dfrac{180.2\ \text{g fructose}}{1\ \text{mol}} = -3.58 \times 10^3\ \text{kJ}$

15. $C_{cal} = \dfrac{330\ \text{kJ}}{43.3^\circ\text{C}} = 7.62\ \text{kJ/}^\circ\text{C}$

17. $q_{rxn} = 0.0100\ \text{g} \times (-24.06\ \text{kJ}/0.500\ \text{g}) = -0.481\ \text{kJ} = -481\text{J}$

$q_{cal} = -q_{rxn} = +481\text{J}; \quad 481\ \text{J} = (5175\ \text{J/}^\circ\text{C})(t_f - 23.6)^\circ\text{C}; \quad t_f = 23.7^\circ\text{C}$

19. $C_{cal} = 9.37\ \text{kJ}/2.48^\circ\text{C} = 3.78\ \text{kJ/}^\circ\text{C}$

$q_{rxn} = -q_{cal} = -[3.78\ \text{kJ/}^\circ\text{C} \times (28.91 - 23.11)^\circ\text{C}] = -21.9\ \text{kJ}$

$\dfrac{-21.9\ \text{kJ}}{1.00\ \text{g}} \times \dfrac{138.1\ \text{g}}{1\ \text{mol}} = -3.02 \times 10^3\ \text{kJ/mol}$

21. (a) $NO(g) + \frac{1}{2}O_2(g) \rightarrow NO_2(g) \qquad \Delta H = -57.0\ \text{kJ}$

(b) exothermic

(c) products 57.0 kJ below reactants

(d) $5.00\ \text{g NO} \times \dfrac{-57.0\ \text{kJ}}{30.01\ \text{g NO}} = -9.50\ \text{kJ}$

(e) $10.0\ \text{kJ} \times \dfrac{30.01\ \text{g NO}}{57.0\ \text{kJ}} = 5.26\ \text{g NO}$

23. (a) $-637\text{ kJ}/4 = -159\text{ kJ}$ (b) $10.00\text{ g NH}_3 \times \dfrac{637\text{ kJ}}{17.03\text{ g NH}_3} = +374\text{ kJ}$

25. (a) $\text{Sr}(s) + \text{C}(s) + \frac{3}{2}\text{O}_2(g) \rightarrow \text{SrCO}_3(s)$ $\Delta H = -1.220 \times 10^3\text{ kJ}$

(b) $n_{\text{O}_2} = \dfrac{(1.00\text{ atm})(10.00\text{ L})}{(0.0821\text{ L}\cdot\text{atm/mol}\cdot\text{K})(298\text{ K})} = 0.409\text{ mol}$; $\Delta H = 0.409\text{ mol O}_2 \times \dfrac{-1220\text{ kJ}}{1.50\text{ mol O}_2} = -332\text{ kJ}$

27. (a) $\text{C}_{57}\text{H}_{104}\text{O}_6(s) + 80\,\text{O}_2(g) \rightarrow 57\,\text{CO}_2(g) + 52\,\text{H}_2\text{O}(l)$ $\Delta H = -3.022 \times 10^4\text{ kJ}$

(b) $5.000\text{ lb} \times \dfrac{453.6\text{ g}}{1\text{ lb}} \times \dfrac{1\text{ mol}}{885.4\text{ g}} \times \dfrac{3.022 \times 10^4\text{ kJ}}{1\text{ mol}} = 7.741 \times 10^4\text{ kJ}$

(c) $7.741 \times 10^4\text{ kJ} \times \dfrac{1\text{ kcal}}{4.184\text{ kJ}} = 1.850 \times 10^4\text{ kcal}$

29. $100.0\text{ g C}_6\text{H}_6 \times \dfrac{1\text{ mol}}{78.11\text{ g}} \times \dfrac{30.8\text{ kJ}}{1\text{ mol}} = 39.4\text{ kJ}$; $20.0\text{ g H}_2\text{O} \times \dfrac{1\text{ mol}}{18.02\text{ g}} \times \dfrac{40.7\text{ kJ}}{1\text{ mol}} = 45.2\text{ kJ}$

boiling water absorbs more heat

31. (a) $\Delta H = 10.0\text{ g Br}_2 \times 0.474\text{ J/g}\cdot{}^\circ\text{C} \times (59.0 - 22.5)^\circ\text{C} = 173\text{ J} = 0.173\text{ kJ}$

(b) $\Delta H = 10.0\text{ g Br}_2 \times \dfrac{1\text{ mol}}{159.8\text{ g}} \times \dfrac{29.6\text{ kJ}}{1\text{ mol}} = 1.85\text{ kJ}$

(c) $1.85\text{ kJ} + 0.173\text{ kJ} = 2.02\text{ kJ}$

33.

$\text{Pb}(s) + \frac{3}{2}\text{O}_2(g) \rightarrow \text{PbO}(s) + \text{SO}_2(g)$	$\Delta H = -415.4\text{ kJ}$
$\text{PbO}(s) + \text{C}(s) \rightarrow \text{Pb}(s) + \text{CO}(g)$	$\Delta H = +108.5\text{ kJ}$
$\text{Pb}(s) + \frac{3}{2}\text{O}_2(g) + \text{C}(s) \rightarrow \text{Pb}(s) + \text{CO(g)} + \text{SO}_2(g)$	$\Delta H = -306.9\text{ kJ}$

35.

$\text{C}_2\text{H}_2(g) + \frac{5}{2}\text{O}_2(g) \rightarrow 2\,\text{CO}_2(g) + \text{H}_2\text{O}(l)$	$\Delta H = -1299.5\text{ kJ}$
$2\,\text{CO}_2(g) \rightarrow \text{C}(s) + 2\,\text{O}_2(g)$	$\Delta H = +787.0\text{ kJ}$
$\text{H}_2\text{O}(l) \rightarrow \text{H}_2(g) + \frac{1}{2}\text{O}_2(g)$	$\Delta H = +285.8\text{ kJ}$
$\text{C}_2\text{H}_2(g) \rightarrow 2\,\text{C}(s) + \text{H}_2\text{(g)}$	$\Delta H = -226.7\text{ kJ}$

37. (a) $\text{C}_2\text{H}_5\text{OH}(l) \rightarrow 2\,\text{C}(s) + 3\,\text{H}_2(g) + \frac{1}{2}\text{O}_2(g)$ $\Delta H = +277.7\text{ kJ}$

(b) $\text{NaF}(s) \rightarrow \text{Na}(s) + \frac{1}{2}\text{F}_2(g)$ $\Delta H = +573.6\text{ kJ}$

(c) $MgSO_4(s) \rightarrow Mg(s) + S(s) + 2\,O_2(g)$ $\Delta H = +1284.9\,kJ$

(d) $NH_4NO_3(s) \rightarrow N_2(g) + 2\,H_2(g) + \frac{3}{2}\,O_2(g)$ $\Delta H = +365.6\,kJ$

39. (a) $\Delta H_f^\circ\ Al_2O_3 = -3351.4\,kJ/2 = -1675.7\,kJ$

(b) $12.50\,g\,Al_2O_3 \times \dfrac{1\,mol\,Al_2O_3}{101.96\,g\,Al_2O_3} \times \dfrac{-1675.7\,kJ}{1\,mol\,Al_2O_3} = -205.4\,kJ$

41. $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

$\Delta H^\circ = -635.1\,kJ - 393.5\,kJ + 1206.9\,kJ = +178.3\,kJ$

$1.000\,g\,CaCO_3 \times \dfrac{1\,mol\,CaCO_3}{100.1\,g\,CaCO_3} \times \dfrac{+178.3\,kJ}{1\,mol\,CaCO_3} = +1.781\,kJ$

43. (a) $\Delta H^\circ = -466.8\,kJ - 92.2\,kJ - 571.6\,kJ + 924.5\,kJ + 265.0\,kJ = +58.9\,kJ$

(b) $\Delta H^\circ = -110.5\,kJ + 219.0\,kJ = +108.5\,kJ$

(c) $\Delta H^\circ = -220.8\,kJ - 296.8\,kJ - 571.6\,kJ + 909.3\,kJ = -179.9\,kJ$

45. (a) $Ca(OH)_2(s) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(g)$

$\Delta H^\circ = -1206.9\,kJ - 241.8\,kJ + 986.1\,kJ + 393.5\,kJ = -69.1\,kJ$

(b) $H_2SO_4(l) \rightarrow H_2O(g) + SO_2(g) + \frac{1}{2}\,O_2(g)$

$\Delta H^\circ = -241.8\,kJ - 296.8\,kJ + 814.0\,kJ = +275.4\,kJ$

47. (a) $C_4H_{10}(g) + \frac{13}{2}\,O_2(g) \rightarrow 4\,CO_2(g) + 5\,H_2O(g)$ $\Delta H = -2658.3\,kJ$

(b) $-2658.3\,kJ = 4(-393.5\,kJ) + 5(-241.8\,kJ) - \Delta H_f^\circ\ C_4H_{10}(g)$; $\Delta H_f^\circ\ C_4H_{10}(g) = -124.7\,kJ/mol$

49. (a) $2\,ClF_3(g) + 2\,NH_3(g) \rightarrow N_2(g) + Cl_2(g) + 6\,HF(g)$ $\Delta H^\circ = -1196\,kJ$

(b) $-1196\,kJ = 6(-271.1\,kJ) + 2(46.1\,kJ) - 2\,\Delta H_f^\circ\ ClF_3(g)$; $\Delta H_f^\circ\ ClF_3(g) = -169\,kJ/mol$

51. $C_6H_{12}O_6(s) \rightarrow 2\,C_2H_5OH(l) + 2\,CO_2(g)$

$\Delta H^\circ = -555.4\,kJ - 787.0\,kJ + 1275.2\,kJ = -67.2\,kJ$

$moles\ C_2H_5OH = 750.0\,mL \times 0.120 \times \dfrac{0.789\,g}{1\,mL} \times \dfrac{1\,mol}{46.07\,g} = 1.54\,mol$

$\Delta H = 1.54\,mol \times \dfrac{-67.2\,kJ}{2\,mol} = -51.8\,kJ$

53. $3.27\ \text{L} \cdot \text{atm} \times \dfrac{0.1013\ \text{kJ}}{1\ \text{L} \cdot \text{atm}} = 0.331\ \text{kJ}$

55. (a) $\Delta E = +18\ \text{J} + 13\ \text{J} = +31\ \text{J}$ (b) $+61\ \text{kJ} = q + 72\ \text{J}; \quad q = -11\ \text{J}$

57. $\Delta E = q + w = -1185\ \text{J} + 623\ \text{J} = -562\ \text{J}$

59. $\Delta H = \Delta E - RT; \quad \Delta H - \Delta E = -8.31\ \text{J/K} \times 298\ \text{K} = -2.48\ \text{kJ}$

61. (a) $C_3H_8(g) + 5\,O_2 \rightarrow 3\,CO_2 + 4\,H_2O(l)$

(b) $\Delta H = 3(-393.5\ \text{kJ}) + 4(-285.8\ \text{kJ}) + 103.8\ \text{kJ} = -2219.9\ \text{kJ}$

$\Delta H = \Delta E - 3(0.00831)(298)\text{kJ}; \quad \Delta E = -2219.9\ \text{kJ} - 3(0.00831)(298)\text{kJ}; \quad \Delta E = -2212.5\ \text{kJ}$

63. $q_{H_2O} = 1.000\ \text{qt} \times \dfrac{1000\ \text{mL}}{1.057\ \text{qt}} \times \dfrac{1.000\ \text{g}}{1\ \text{mL}} \times 4.18\ \text{J/g} \cdot {}^\circ\text{C} \times (100 - 20)^\circ\text{C} = 3.16 \times 10^5\ \text{J} = 316\ \text{kJ}$

$\Delta H = -393.5 + 2(-241.8) - (-74.8) = -802.3\ \text{kJ}$

$q_{\text{reaction}} = -q_{H_2O} = -316\ \text{kJ}; \quad \text{mol } CH_4 = -316\ \text{kJ} \times \dfrac{1\ \text{mol } CH_4}{-802.3\ \text{kJ}} = 0.394$

$V = \dfrac{(0.394\ \text{mol})(0.0821\ \text{L} \cdot \text{atm/mol} \cdot \text{K})(293\ \text{K})}{1.00\ \text{atm}} = 9.47\ \text{L}$

65. (a) $1.000\ \text{therm} = \dfrac{1.00 \times 10^5\ \text{BTU}}{1\ \text{therm}} \times \dfrac{1\ \text{J}}{9.48 \times 10^{-4}\ \text{BTU}} = 1.05 \times 10^8\ \text{J}$

(b) $\Delta H = 3(-393.5) + 4(-241.8) - (-103.8) = -2043.9\ \text{kJ}$

$\dfrac{2043.9\ \text{kJ}}{1\ \text{mol } C_3H_8} \times \dfrac{1 \times 10^3\ \text{J}}{1\ \text{kJ}} \times \dfrac{1\ \text{therm}}{1.05 \times 10^8\ \text{J}} = 0.0195\ \text{therm}$

67.

$N_2(g) + 2\,H_2O(g) \rightarrow N_2H_4(l) + O_2(g)$	$\Delta H = -(-534.2)\ \text{kJ}$
$2\,H_2(g) + O_2(g) \rightarrow 2\,H_2O(g)$	$\Delta H = 2(-241.8)\ \text{kJ}$
$N_2(g) + 2\,H_2(g) \rightarrow N_2H_4(l)$	$\Delta H = 50.6\ \text{kJ}$

69. $1.0\ \text{lb fat} \times \dfrac{454\ \text{g}}{1\ \text{lb}} \times \dfrac{32\ \text{kJ}}{1\ \text{g}} \times \dfrac{1\ \text{kcal}}{4.18\ \text{kJ}} \times \dfrac{0.500\ \text{h}}{225\ \text{kcal}} = 7.7\ \text{h}$

71. mass of brass $= (2.200\ \text{cm})^3 \times (8.25\ \text{g/cm}^3) = 87.8\ \text{g}$

$q_{\text{brass}} = -q_{H_2O}$

$87.8\ \text{g} \times 0.362\ \text{J/g} \cdot {}^\circ\text{C} \times (t_f - 95.0)^\circ\text{C} = -[20.0\ \text{g} \times 4.18\ \text{J/g} \cdot {}^\circ\text{C} \times (t_f - 22.0)^\circ\text{C}]; \quad t_f = 42.1^\circ\text{C}$

73. $E_{\text{microwave}} = \dfrac{(6.626 \times 10^{-34}\ \text{J} \cdot \text{s}) \times (2.998 \times 10^{8}\ \text{m/s})}{0.125\ \text{m}} = 1.59 \times 10^{-24}\ \text{J/photon}$

$q_{H_2O} = 350.0\ \text{g} \times 4.18\ \text{J/g} \cdot {}^\circ\text{C} \times (99.0 - 23.0)^\circ\text{C} = 1.11 \times 10^{5}\ \text{J}$

$1.11 \times 10^{5}\ \text{J} \times \dfrac{1\ \text{photon}}{1.59 \times 10^{-24}\ \text{J}} \times \dfrac{1\ \text{mol}}{6.022 \times 10^{23}\ \text{photons}} = 1.16 \times 10^{5}\ \text{mol}$

75 (a) $q = (100.0 \times 10^{3}\ \text{g}) \times (0.82\ \text{J/g} \cdot {}^\circ\text{C}) \times (12^\circ\text{C}) = 9.8 \times 10^{5}\ \text{J}$

(b) $\dfrac{9.8 \times 10^{5}\ \text{J}}{2\ \text{m}^2} \times \dfrac{1\ \text{m}^2}{170\ \text{watt}} \times \dfrac{1\ \text{watt}}{1\ \text{J/s}} \times \dfrac{1\ \text{min}}{60\ \text{s}} = 48\ \text{min}$

77. Volume increases; work is done by the system.

79. (a) T (b) T (c) T (d) F (e) F

81. (a) T (b) T (c) F (d) T

83. (a) T (b) T (c) F (d) F

84. $E_{\text{microwave}} = \dfrac{(6.626 \times 10^{-34}\ \text{J} \cdot \text{s}) \times (2.998 \times 10^{8}\ \text{m/s})}{0.125\ \text{m}} = 1.59 \times 10^{-24}\ \text{J/photon}$

$q_{H_2O} = 100.0\ \text{g} \times 4.18\ \text{J/g} \cdot {}^\circ\text{C} \times (80.0)^\circ\text{C} = 3.34 \times 10^{4}\ \text{J}$

$3.34 \times 10^{4}\ \text{J} \times \dfrac{1\ \text{photon}}{1.59 \times 10^{-24}\ \text{J}} = 2.1 \times 10^{28}\ \text{photon}$

85. (a) $(12.5\ \text{g} \times 20.0^\circ\text{C} \times 6 \times 0.902\ \text{J/g} \cdot {}^\circ\text{C}) + \left(\dfrac{72.0}{16.0}\ \text{lb} \times \dfrac{453.6\ \text{g}}{1\ \text{lb}} \times 4.10 \dfrac{\text{J}}{\text{g} \cdot {}^\circ\text{C}} \times 20.0^\circ\text{C}\right) = 1.68 \times 10^{5}\ \text{J}$

(b) $168\ \text{kJ} \times \dfrac{18.02\ \text{g}}{6.00\ \text{kJ}} = 505\ \text{g}$

86. room temperature $\approx 25^\circ\text{C}$

Assume 100 g water: $q = 100\ \text{g} \times 25^\circ\text{C} \times 4.18\ \text{J/g} \cdot {}^\circ\text{C} = 10{,}400\ \text{J}$

mass of ice required $= 10.4\ \text{kJ} \times \dfrac{1\ \text{mol}}{6.00\ \text{kJ}} \times \dfrac{18.02\ \text{g}}{1\ \text{mol}} = 31.2\ \text{g}$

$V_{H_2O} = \dfrac{100\ \text{g}}{1.00\ \text{g/cm}^3} = 100\ \text{cm}^3; \qquad V_{\text{ice}} = \dfrac{31.2\ \text{g}}{0.90\ \text{g/cm}^3} = 35\ \text{cm}^3$

fraction = 35/(100 + 35) = 0.26

87. (a) $\Delta H = \Delta H_f^\circ \, Al_2O_3(s) - \Delta H_f^\circ \, Fe_2O_3(s) = -851.5 \text{ kJ}$

(b) $851500 \text{ J} = [(0.77 \text{ J/g} \cdot {}^\circ\text{C})(101.96 \text{ g}) + (0.45 \text{ J/g} \cdot {}^\circ\text{C})(111.7 \text{ g})] \Delta t; \quad \Delta t = 6600^\circ\text{C}$

(c) Yes

88. Let x = mass of sucrose

$q = (22.51 \text{ kJ/}^\circ\text{C})(1.67^\circ\text{C})$

$(22.51 \text{ kJ/}^\circ\text{C})(1.67^\circ\text{C}) = \dfrac{5640 \text{ kJ}}{342.3 \text{ g}}(x); \quad x = 2.28 \text{ g}; 76.0\%$

89. $E_{\text{microwave}} = \dfrac{(6.626 \times 10^{-34} \text{ J} \cdot \text{s}) \times (2.998 \times 10^8 \text{ m/s})}{0.135 \text{ m}} = 1.47 \times 10^{-24} \text{ J/photon}$

$q = 1.47 \times 10^{-24} \dfrac{\text{J}}{\text{photon}} \times \dfrac{6.022 \times 10^{23} \text{ photons}}{1 \text{ mol}} \times \dfrac{925 \text{ mol}}{\text{s}} \times 1.55 \text{ s} = 1270 \text{ J}$

$1270 \text{ J} = \text{mass} \times (0.45 \text{ J/g} \cdot {}^\circ\text{C}) \times (400 - 25)^\circ\text{C}; \quad \text{mass} = 7.50 \text{ g}$